

In the Drawings

Please replace drawing sheets 2 and 4 with the attached amended drawing sheets labeled Replacement Sheet 2 and Replacement Sheet 4.

Remarks

In response to the Examiner's objections and rejections, described below, the following amendments are included: replacement drawing sheets 2 and 4, amended abstract, headings to be inserted into the specification, amended paragraphs 45, 47 and 49, amended claims 1, 6, 8, 10, 12, 13, 15-20, 24, 26, 31, 33, and 34, and new claim 36. Claims 3, 5, 14, and 27 are cancelled. Applicant respectfully submits that no new matter was added by the amendment, as all of the amended matter was either previously illustrated or described in the drawings, written specification and/or claims of the present application. Entry of the amendment and favorable consideration thereof is earnestly requested.

The Examiner has objected to the drawings under 37 CFR 1.83(a). The Examiner has also objected to the specification. The Examiner has rejected the claims as follows: (1) claims 1-13 and 15-35 under 35 U.S.C 112, second paragraph, as indefinite; (2) claims 1-13 and 15-31 under 35 U.S.C. 103(a) as being obvious over Stelle (U.S. Patent No. 3,266,059) in view of Raines (U.S. Patent No. 5,297,874); and (3) claims 32-35 under 35 U.S.C. 103(a) as being obvious over Stelle in view of Raines and Birchard (U.S. Patent No. 4,751,821). These objections and rejections are respectfully traversed.

Drawing Objections

Applicant has amended Figures 2 and 4 in response to the Examiner's objections to the drawings.

Specification Objections

Applicant has provided a replacement Abstract. Applicant has further amended the specification to include headings per the Examiner's suggestion. Applicant has still further amended paragraphs 45, 47 and 49. Applicant respectfully submits that no new matter was added by the amendment, as all of the amended matter was previously illustrated in the written specification of the present application, for example, on page 25, lines 1 – 16; page 26, lines 1 – 11. page 28, lines 6 – 9 and 13 – 18.

35 U.S.C. § 112, Second Paragraph Rejections

Applicant has amended the claims in response to the Examiner's comments.

35 U.S.C. § 103 Rejections

Claims 1 and 36

As amended, Claim 1 recites, "elastomer means being keyed or bonded to both of the first and second link members whereby the layer is sufficiently thin that a bending movement between the members produces shear movement within the elastomer means and substantially no compressive movement as a result of the relative movement between the said first and said second members." In addition, Claim 36 requires, the adjacent surfaces of said first, second, and third link members being keyed

to one another such that during articulation of the arm the distances between the adjacent surfaces remains substantially constant; the elastomer material permitting shear deformation of the elastomer material during articulation of the assembly, and the elastomer material substantially preventing compressive deformation of the elastomer material during articulation of the assembly.

Thus, all the claims require that shear movement may take place within the elastomer means, but substantially no compression is permitted. Applicant respectfully submits that neither the '059 patent nor the '874 patent teaches, discloses, or suggests this limitation.

Neither the '059 patent nor the '874 patent render claim 1 obvious in view of each other, as even if the two references were combined, one would not arrive at claim 1. For example, the '059 patent teaches "compressive resilient material, such as formed rubber, foamed [sic] plastic, and the like" placed between individual links. (Col. 4, 67-72.) This compressive resilient material is used to allow movement between the links. (Col. 4, 64-67.) Indeed, movement of the joint in the embodiment described at the bottom of column 4 in the '059 patent is only possible as a result of the compressibility of the elastomer material.

The '874 patent teaches an elastomeric bearing designed to protect the rigid layers contained within the elastomeric bearing from overstress as a result of repeated compressions. (Col. 1, 58-61.) Therefore, any combination of the '059 patent with the

'874 patent, would not produce a system that allows substantially no compressive movement as required by Claim 1, or substantially prevents compressive deformation of the elastomer material as required by Claim 36. Accordingly, no combination of these references can render either Claim 1 or Claim 36 obvious.

It is also well settled that if the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). In contrast with Claim 1 and Claim 36, combination of the '874 patent with the '059 patent would yield a joint that is dependent on the compression of elastomer to function. In the present case, Applicant respectfully submits that no only would such a combination not result in the claimed subject matter, but any further modification of the combined references to prevent compressive movement of the elastomer material would defeat the purposes of the cited references. For example, while the '059 patent involves links with concave and convex interfacing surfaces disposed in contact with one another, compressible elastomer is only to be used in embodiments that specifically do not use concave and convex interfacing surfaces. (Col. 4, 65-67). Accordingly, the '059 patent teaches away from such a modification.

Similarly, the '874 patent teaches the use of non-planar reinforcing interleaf layers that resist overstressing within a elastomeric bearing due to high compressive forces. (Col. 1, 58-61; Col. 4, 42-44). The '874 patent does not teach use of an

elastomeric bearing for anything but compressive movements. In fact, the specification of the '874 patent specifically teaches that the apparatus taught in the '874 patent is formed to accommodate high compressive loads. (col. 4, lines 42 – 64).

Accordingly, Applicant respectfully submits that both references teach away from any modification to allow substantially no compressive movement.

The Examiner indicates that it would have been obvious to one of skill in the art to discover the optimum range of thickness of the elastomer material in light of the '874 patent. However, the elastomer bearing disclosed by the '874 patent is intended to be compressible so as to absorb energy from conical movements between two components. (Col. 1, 8-11.) It is respectfully submitted, therefore, that the '874 patent does not teach use of elastomer material that is so thin that only shear movement and not compressive movement will be allowed within it, which is required by all the claims.

It is well settled that the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990). Given that the '059 patent and the '874 patent are non-analogous pieces of prior art, a person skilled in the art of robotics would have no motivation to combine the bearing disclosed in the '874 patent with the joint structure disclosed in the '059 patent. The bearing disclosed in the '874 patent is intended to handle large compressive loads, such as on underwater oil well pipelines. (Col.1, 8-17.) Accordingly, one skilled in the

art would not seek to use that type of bearing for the elastomer portions that allow movement between the links in the '059 patent, which provide a relatively small, precise spring force.

Claims 32 – 35

Claim 32 requires “the sheathed segment” of the robot arm to be “filled with a lubricant.” Claim 35 requires a lubricant cooling means “for cooling the arm when used in an aggressive environment.” Lubricant cooling means are not used for supplementary actuation of the robot arm. Applicant respectfully submits that the '059 patent, the '874 patent and the '821 patent all fail to teach, disclose, or suggest this element.

For example, the '821 patent teaches a snake-like robotic arm that is actuated by the controlled expansion and contraction of individual cells that make up the arm. (Abstract). The expansion and contraction of the individual links is accomplished via heating and cooling of the cells. (Col. 2, 48-53). The '821 patent does not suggest or teach use of a lubricant heating or cooling means “for cooling the arm” to maintain for example, a steady operating temperature within the structure of the robot arm. What is taught is use of a “heating or cooling fluid” to expand or contract parts of the cells. (Col. 8, 39-47). However, the lubricant heating or cooling means maintains the lubricant, and therefore the robot arm, at a constant temperature. (Para. 59.) This aspect of the present invention allows uniform performance in environments of varying temperatures.

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Thus, it is respectfully submitted that since the '821 patent teaches use of a fluid to vary the temperature of the robot arm, claims 32-35 are not obvious in view of the '821 patent.

It is respectfully submitted that claims 1 – 2, 4, 6 – 13, 15 – 26 and 28 – 36, all of the claims remaining in the application, are in order for allowance and early notice to that effect is respectfully requested.

Respectfully submitted,

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FIG.3

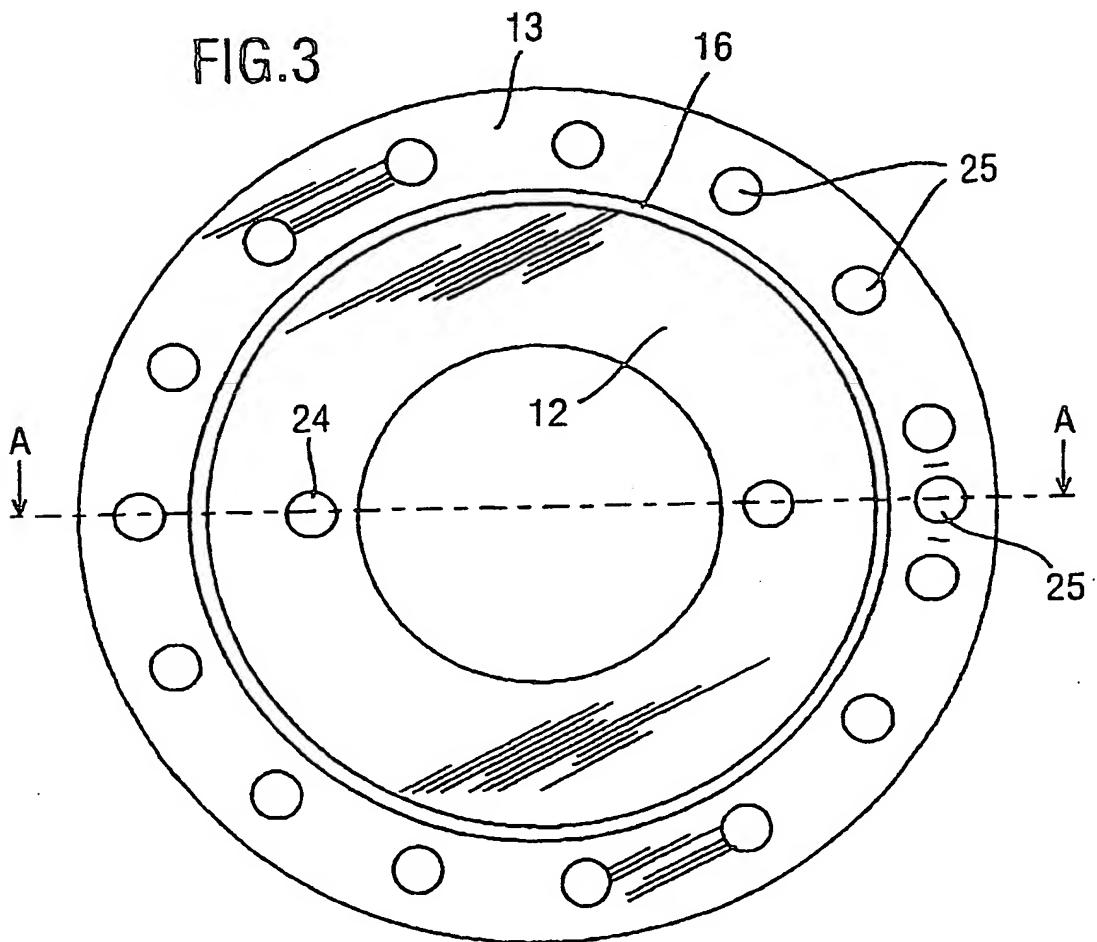


FIG.3a

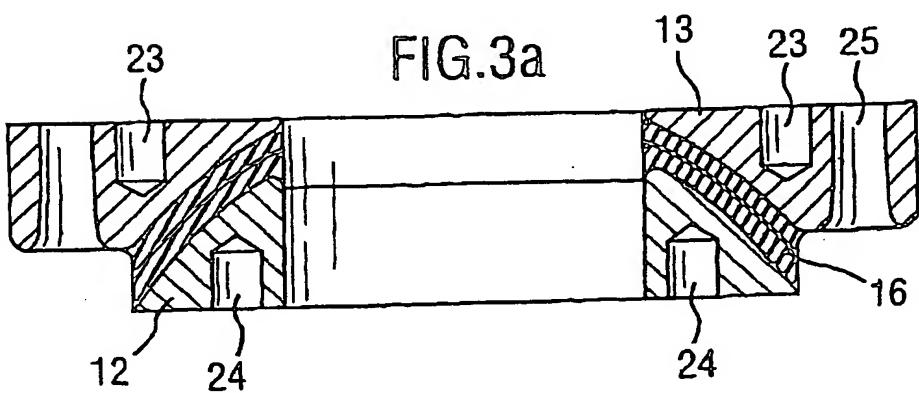


FIG.5

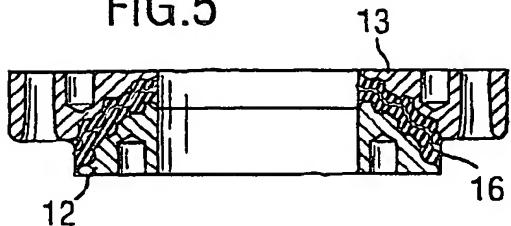


FIG.6

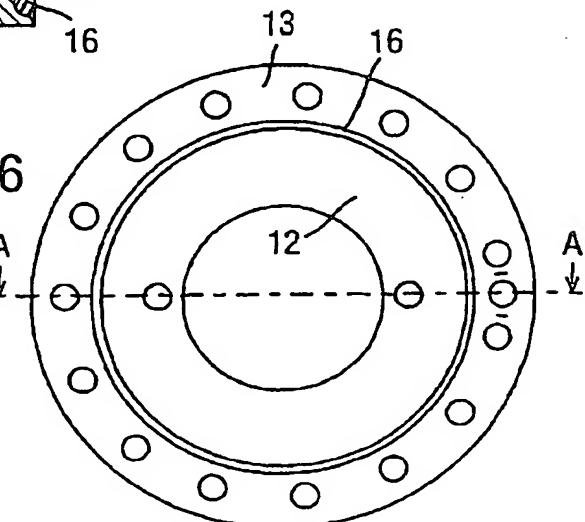


FIG.7

